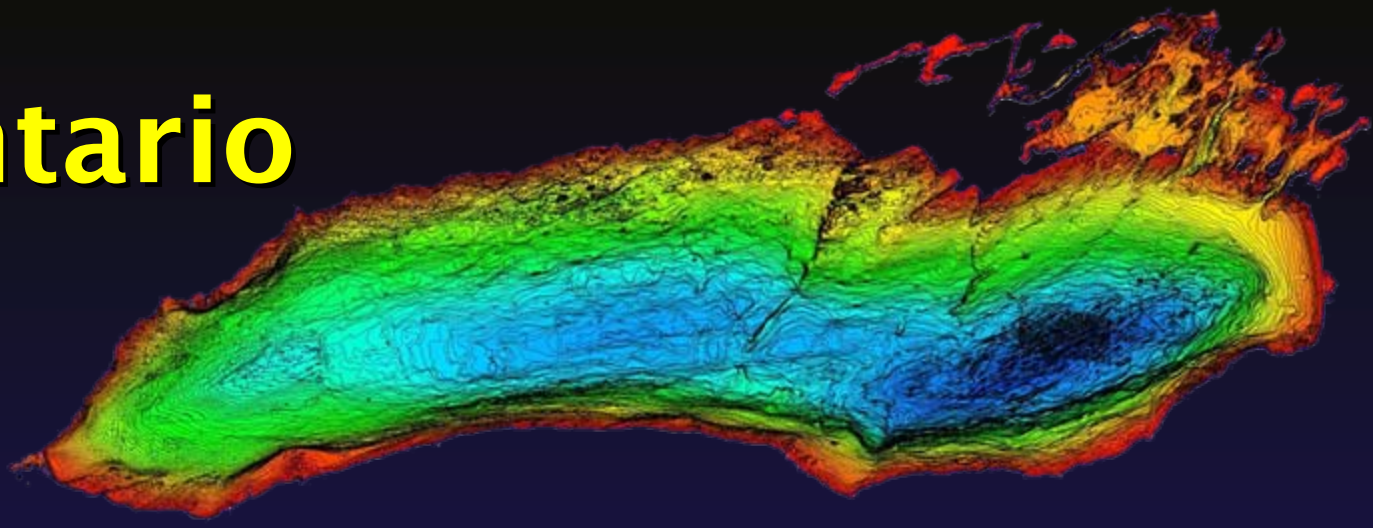
Lake Ontario

Douglas A. Wilcox
SUNY-Brockport

Lake Ontario



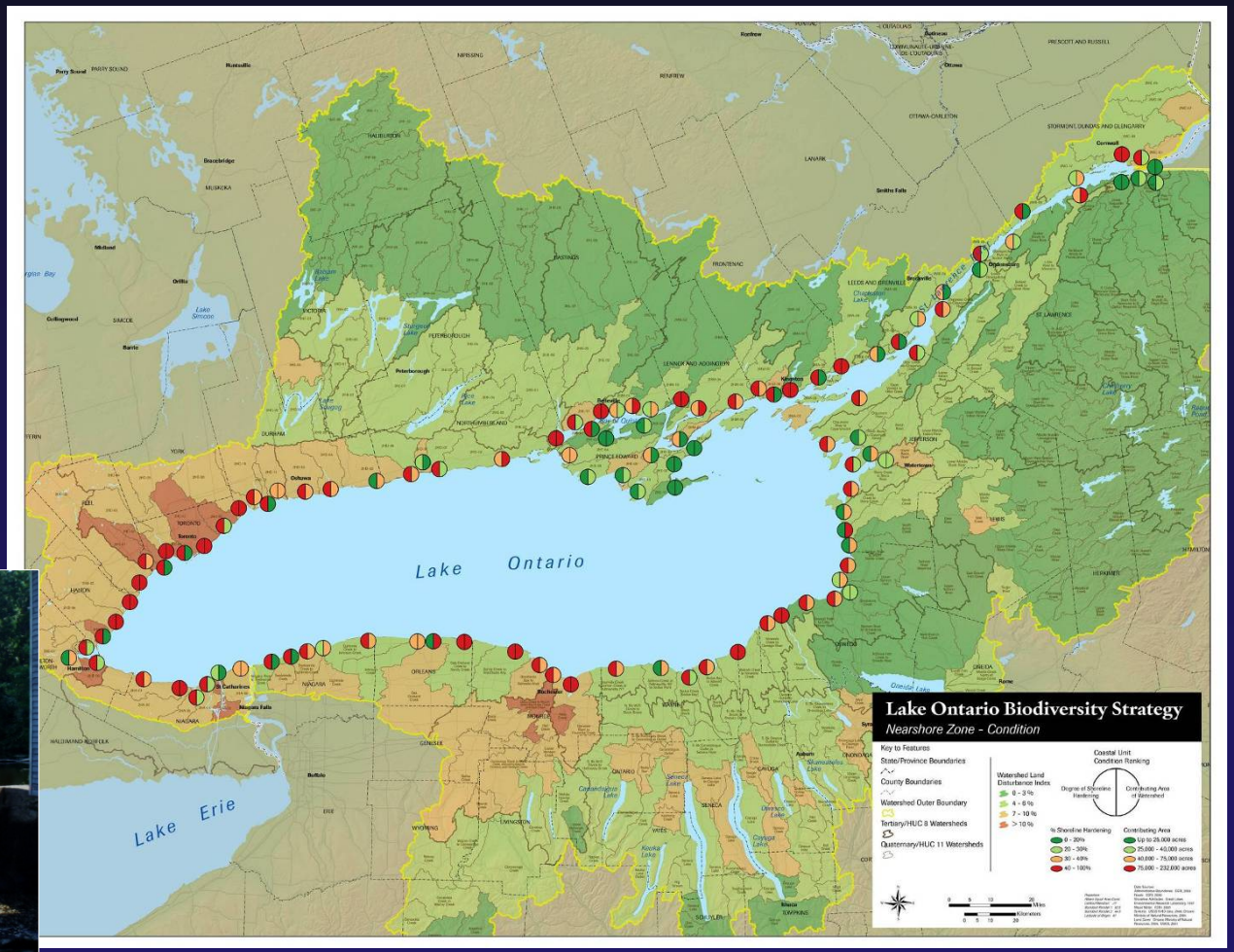
Average Depth	283 feet 86 meters	**Land Drainage Area**	24,720 sq. mi. 64,030 sq. km.
Maximum Depth	802 feet 244 meters	**Shoreline Length**	712 mi. 1,146 km.
Volume	393 cu. mi. 1,640 cu. km.	**Population** US (2000); Can (2001)	9,751,655
Water Area	7,340 sq. mi. 18,960 sq. km.	**Retention Time**	6 years

Source: State of the Great Lakes 2005; NOAA, GLERL

Status of Lake Ontario Progress

- Lake Ontario indicators measure the health of the ecosystem
- Critical pollutant indicators show progress
- Overall, contaminant levels in young fish, herring gull eggs, and Lake trout continue to decline
- LaMP objectives for bird populations, bald eagle, mink and otter achieved

Lake Ontario Biodiversity Conservation Strategy



Status of Lake Ontario Progress

- Extensive coastal wetlands—indicators being developed
- Water level alterations—adaptive management

Lake Ontario Challenges

- LaMP objectives for lower food web and Lake trout populations not met
- Nearshore nutrients, algal blooms, invasive exotic species, human impacts on habitat
- Lake Ontario Binational Cooperative research and Monitoring Year 2008 focused on lower food web problems

SOLEC Indicators
Coastal Wetlands

- Invertebrate communities
- Fish communities
- Amphibian communities
- Bird communities
- Plant communities
- Landscape extent and composition

SOLEC Indicators
Coastal Wetlands

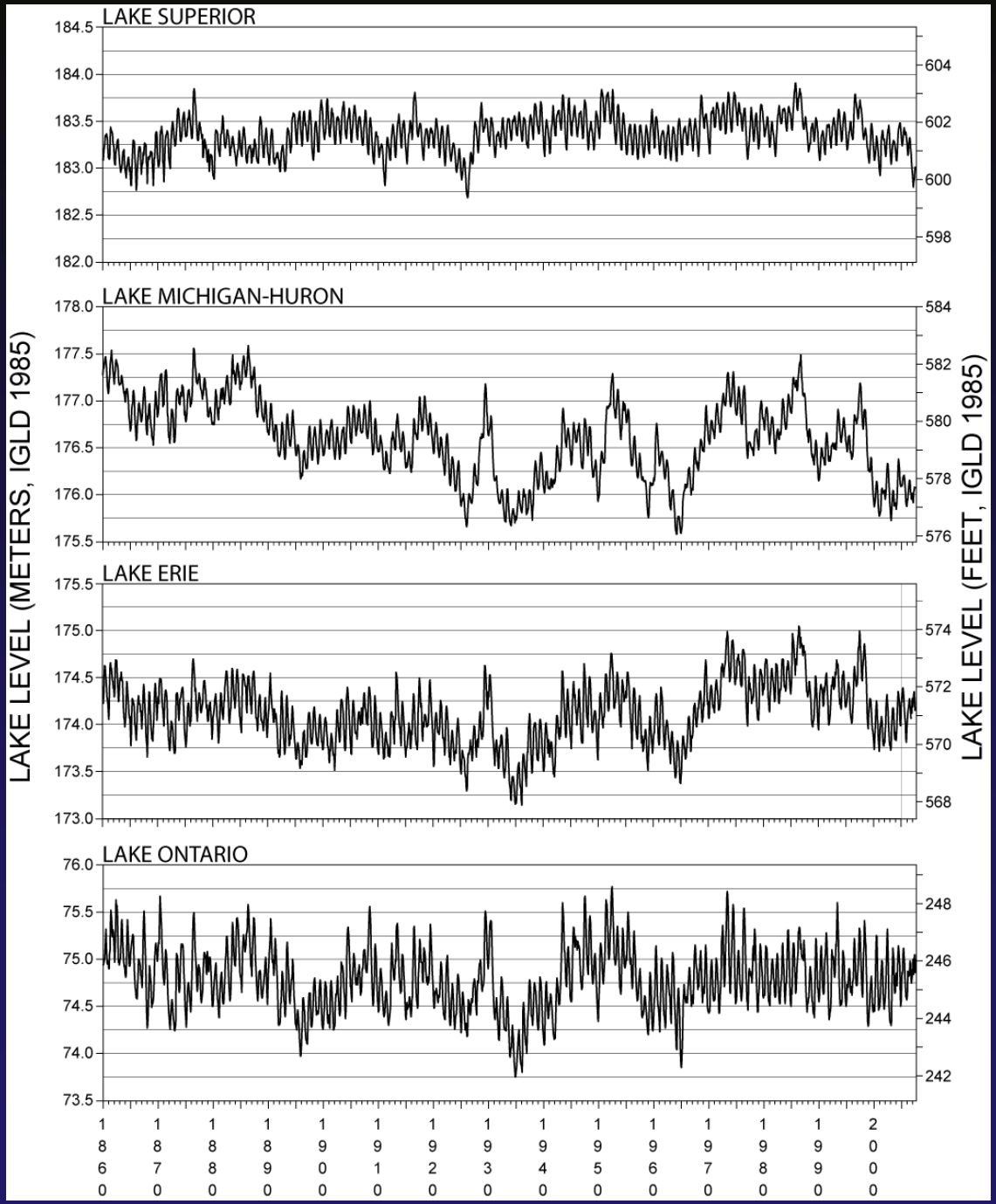
- Human impact measures
- Adjacent land cover
- Wetland area by type
- *Restored area by type*
- *Sediment inflow*
- *Sediment available for coastal nourishment*
- *Phosphorus and nitrogen levels*

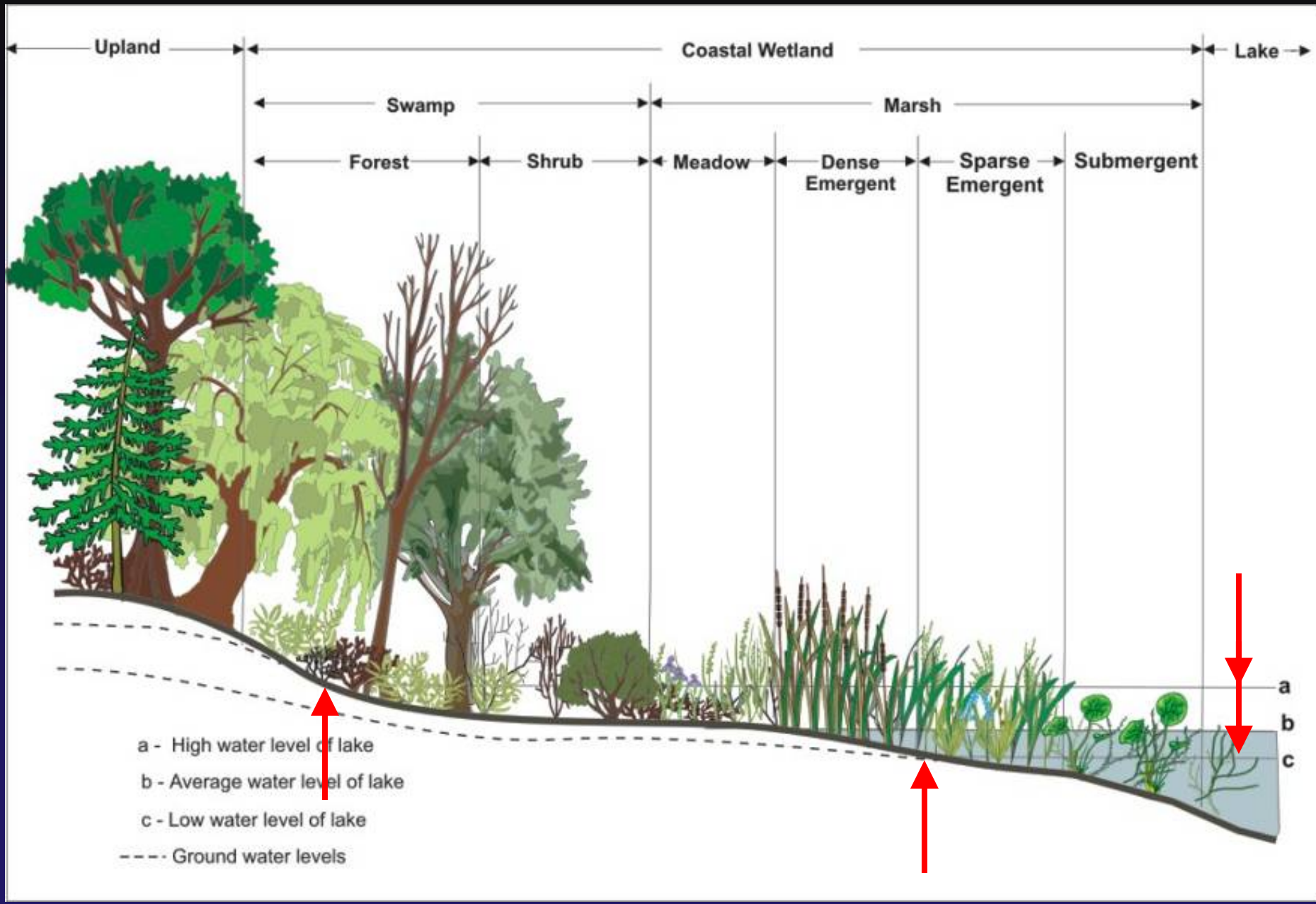
SOLEC Indicators
Wetland Related

- Non-native species
- Ground-water dependent plants/animals
- Base flow of ground-water discharge
- Extent of hardened shoreline
- *Artificial coastal structures*

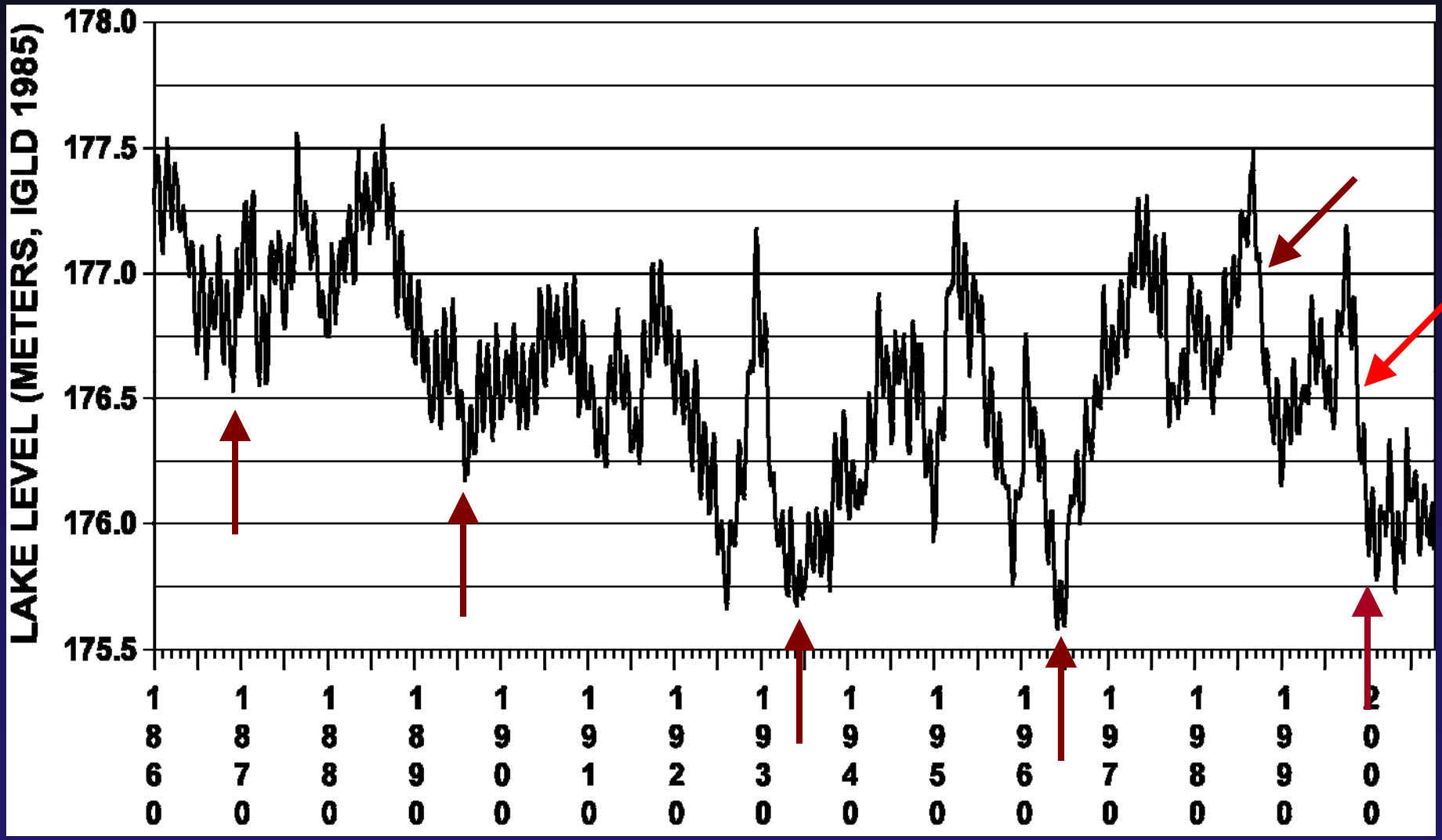
SOLEC Indicators
Coastal Wetlands

- Effects of water level fluctuations


LAKE SUPERIOR
184.5
184.0
183.5
183.0
182.5
182.0
604
602
600
598
LAKE MICHIGAN-HURON
178.0
177.5
177.0
176.5
176.0
175.5
584
582
580
578
576
LAKE ERIE
175.5
175.0
174.5
174.0
173.5
173.0
574
572
570
568
LAKE ONTARIO
76.0
75.5
75.0
74.5
74.0
73.5
248
246
244
242
LAKE LEVEL (METERS, IGLD 1985)
LAKE LEVEL (FEET, IGLD 1985)
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

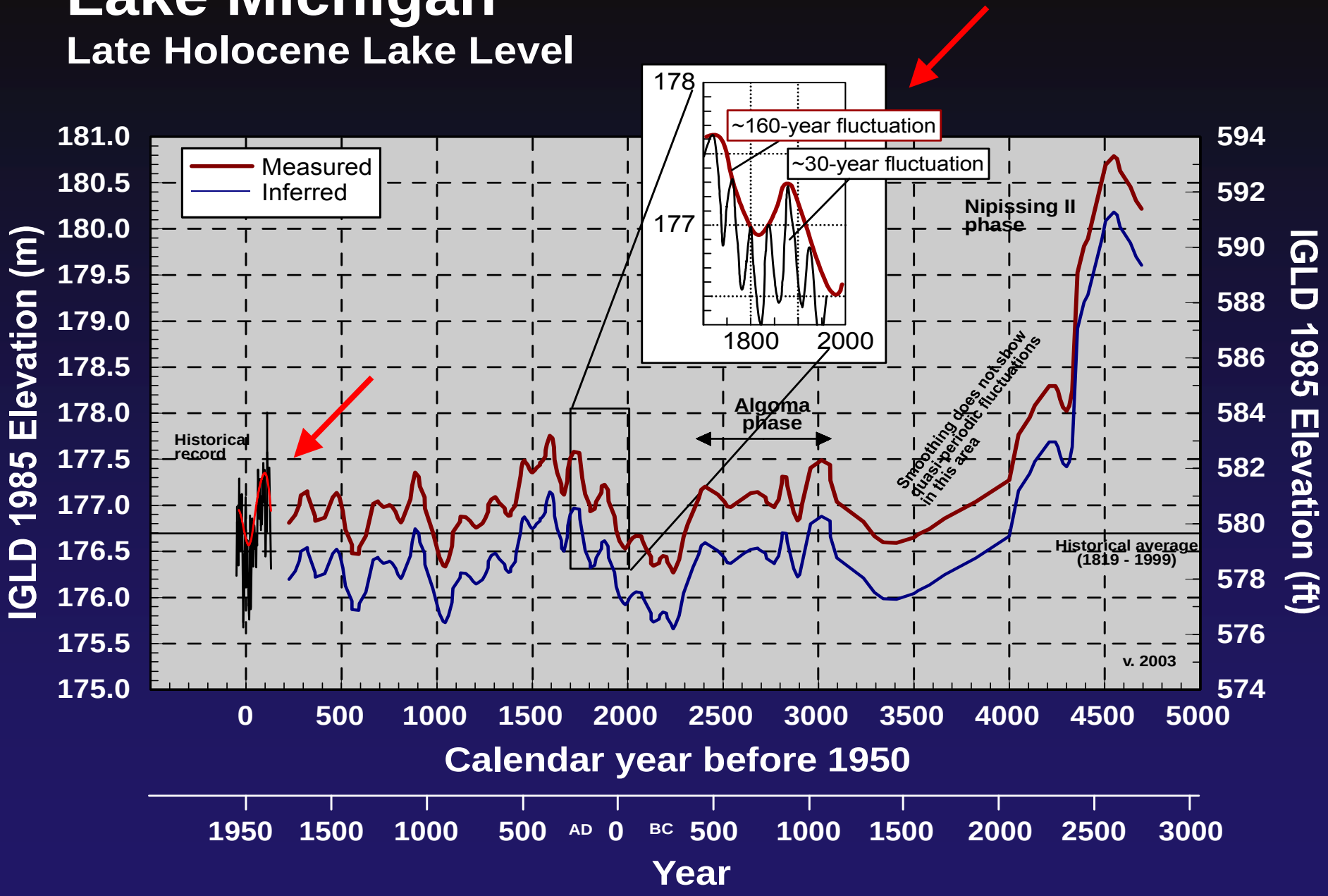

Upland
Coastal Wetland
Lake
Swamp
Marsh
Forest
Shrub
Meadow
Dense Emergent
Sparse Emergent
Submergent
a
b
c
a - High water level of lake
b - Average water level of lake
c - Low water level of lake
Ground water levels

Lakes Michigan - Huron



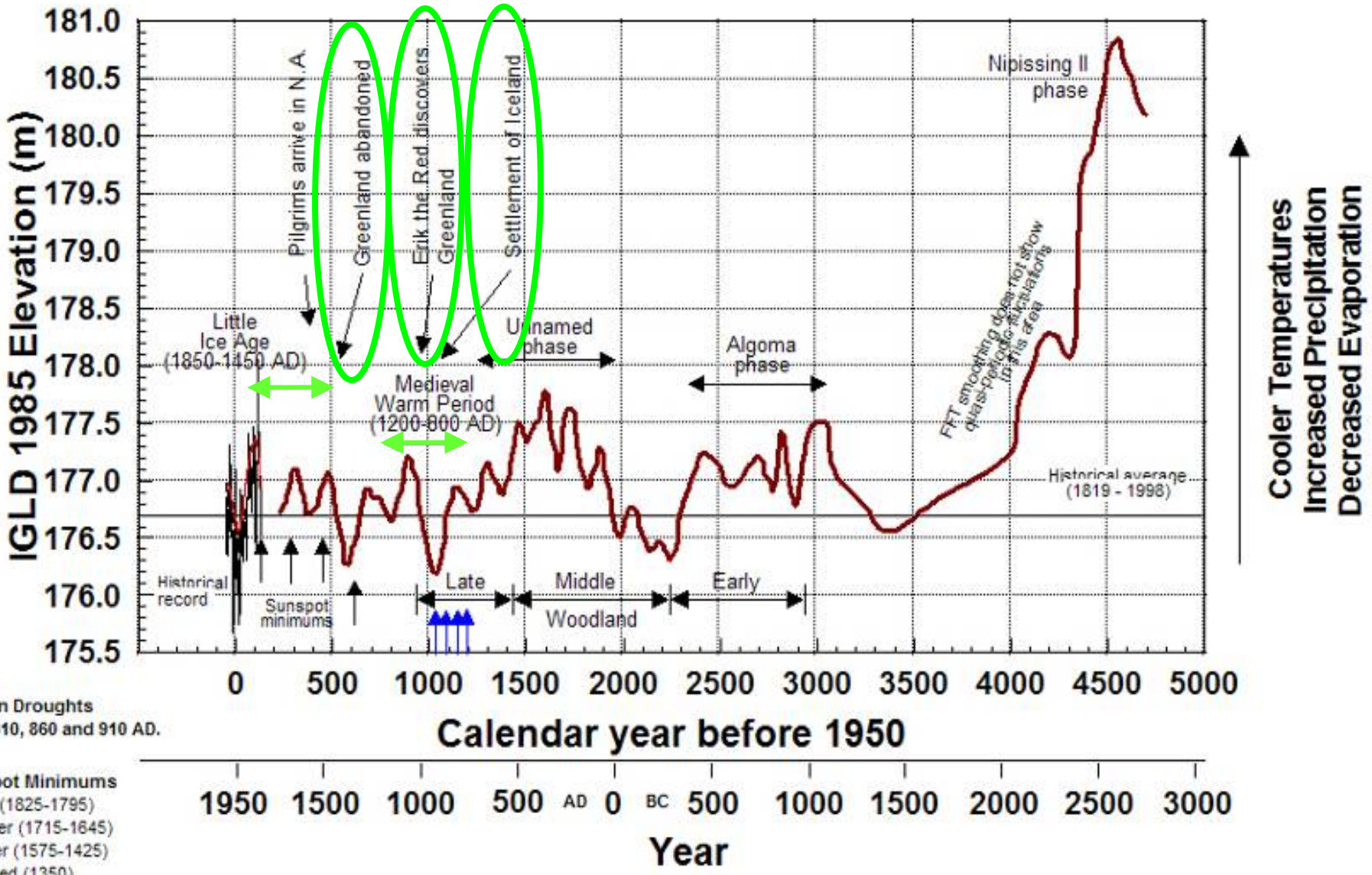
Lake Michigan

Late Holocene Lake Level



Lake Michigan

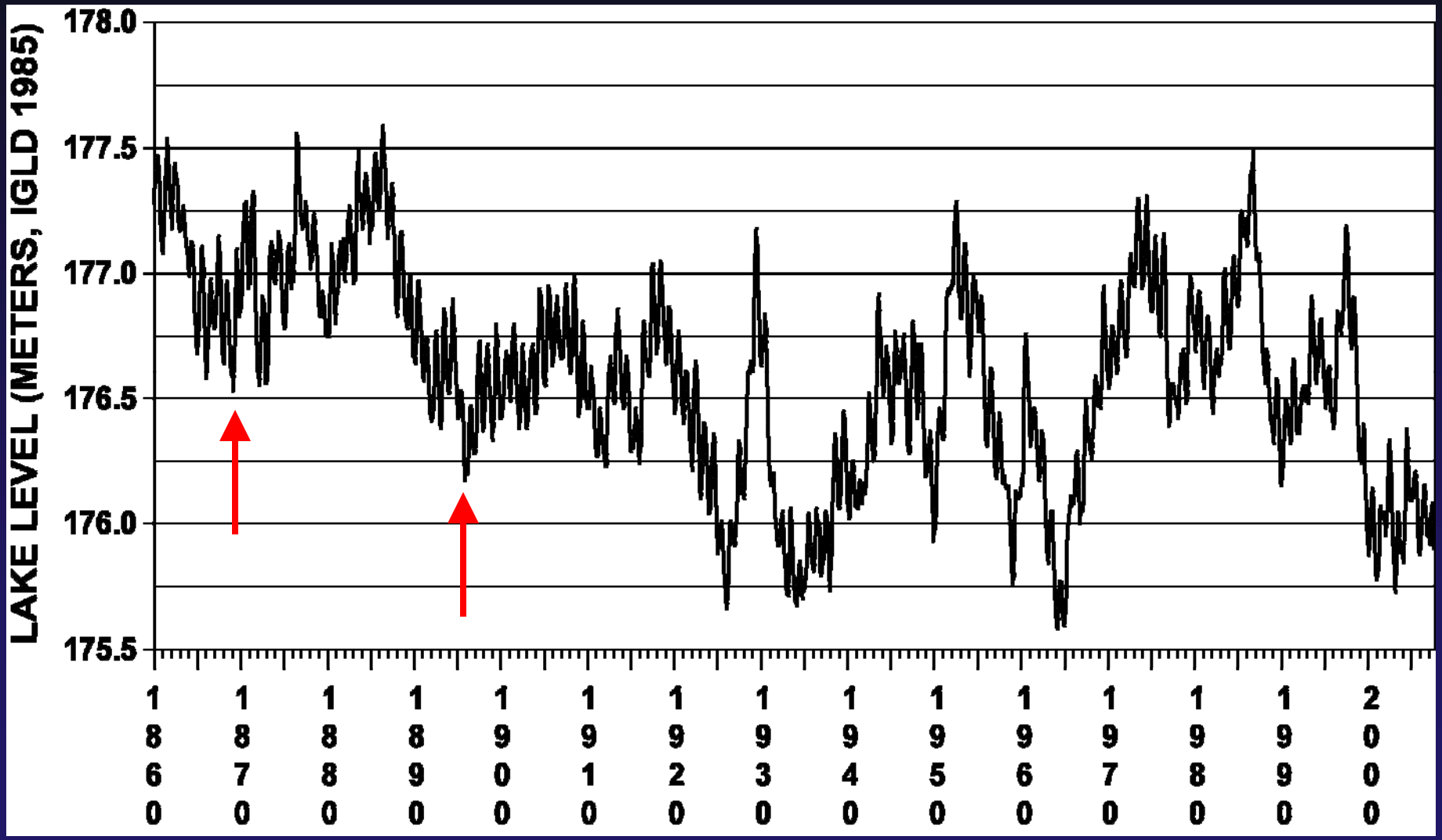
Late Holocene Lake Level



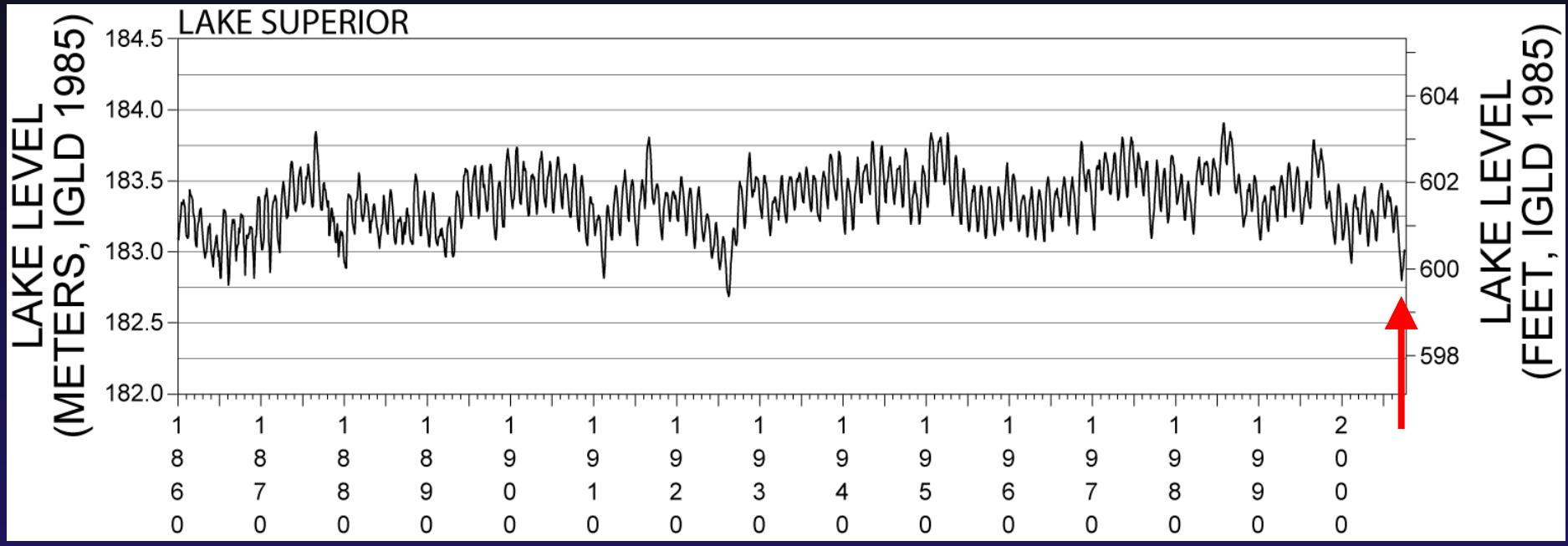
Mayan Droughts
760, 810, 860 and 910 AD.

Sunspot Minimums
Dalton (1825-1795)
Maunder (1715-1645)
Spoerer (1575-1425)
Unnamed (1350)

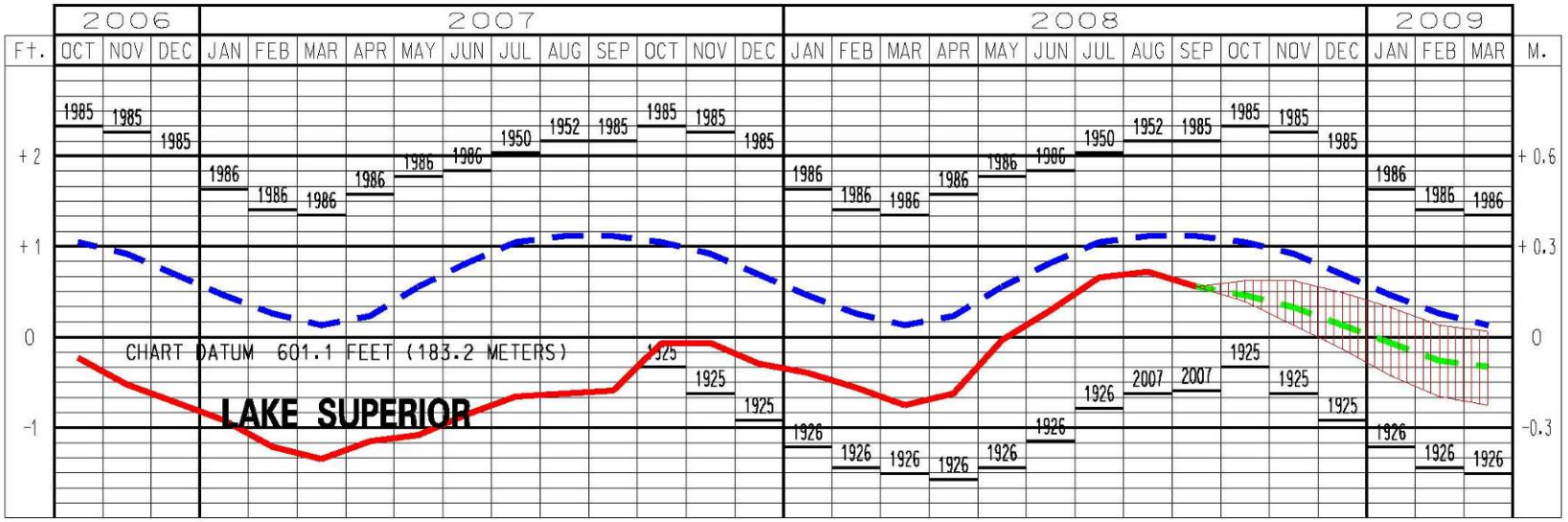
Lakes Michigan - Huron



Lake Superior



LAKE SUPERIOR WATER LEVELS – OCTOBER 2008



LEGEND

LAKE LEVELS

RECORDED

PROJECTED

AVERAGE **

MAXIMUM ** 1985 1985 1973 1973

MINIMUM ** 1936 1934 1926 1934

** Average, Maximum and Minimum for period 1918-2007

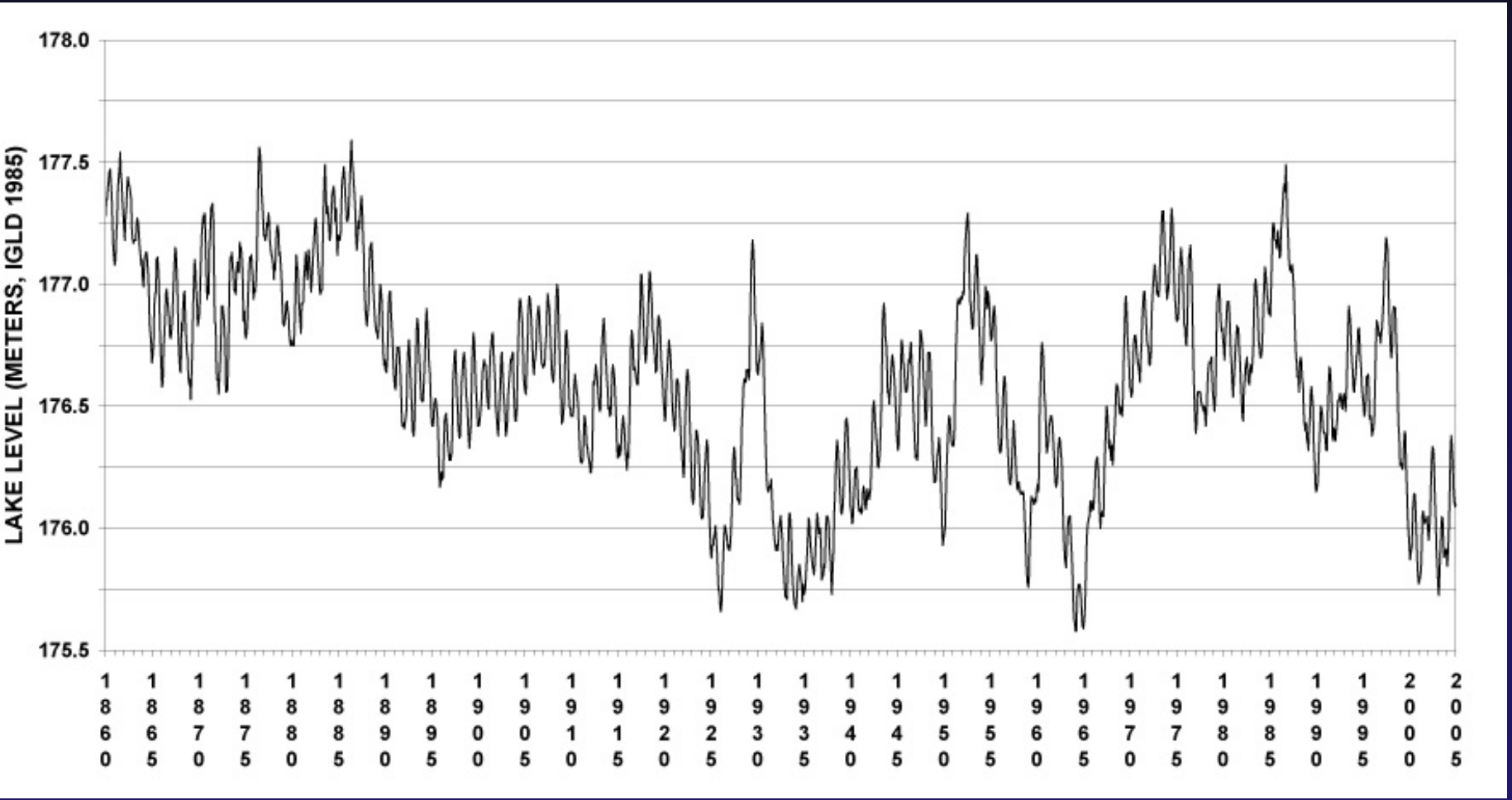
HERBERT C. JACKSON

This is your house on the floodplain.

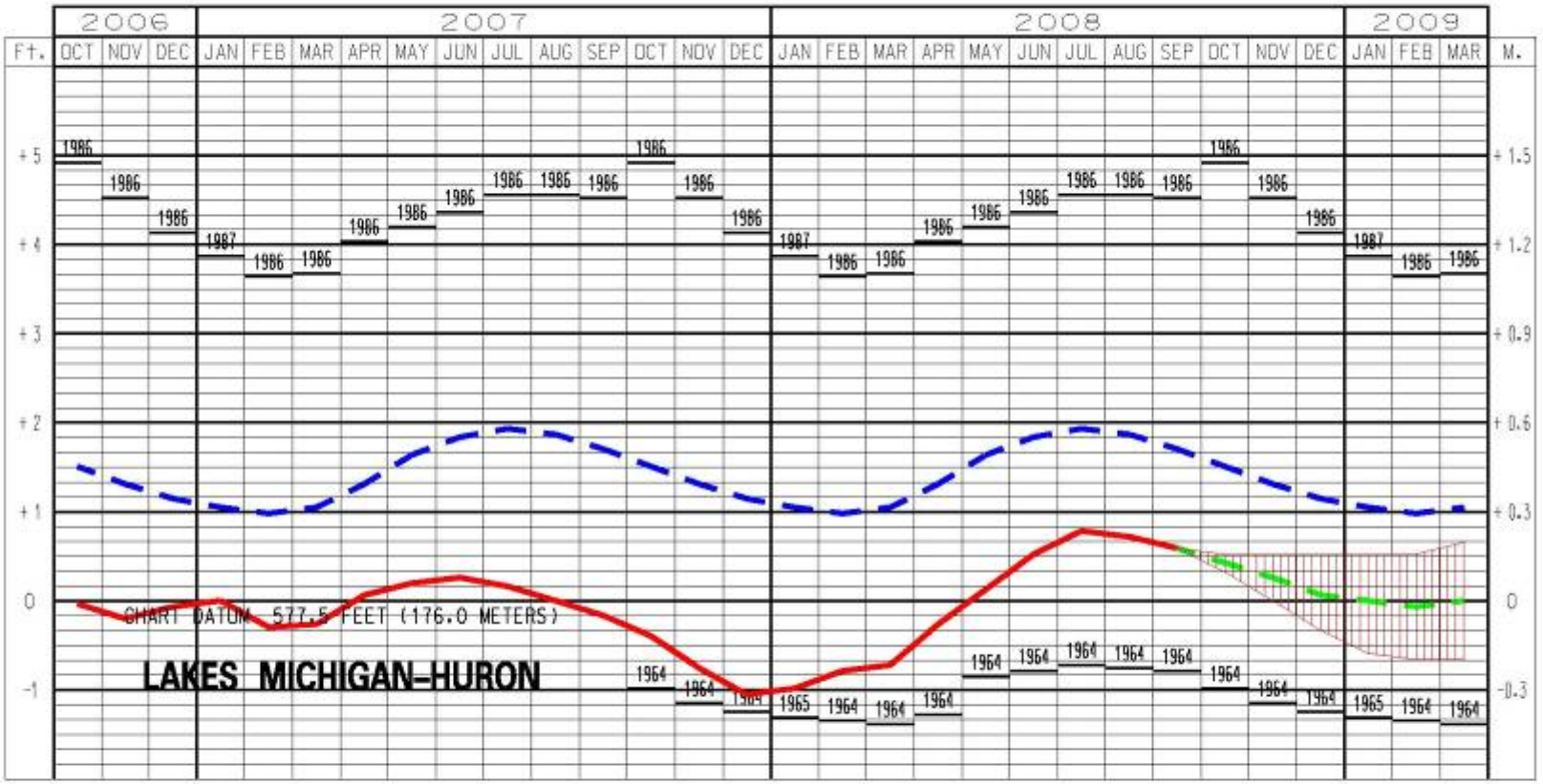
This is the floodplain on your house.

Any questions ??

Lakes Michigan - Huron



LAKES MICHIGAN-HURON WATER LEVELS – OCTOBER 2008



LEGEND

LAKE LEVELS

RECORDED

PROJECTED

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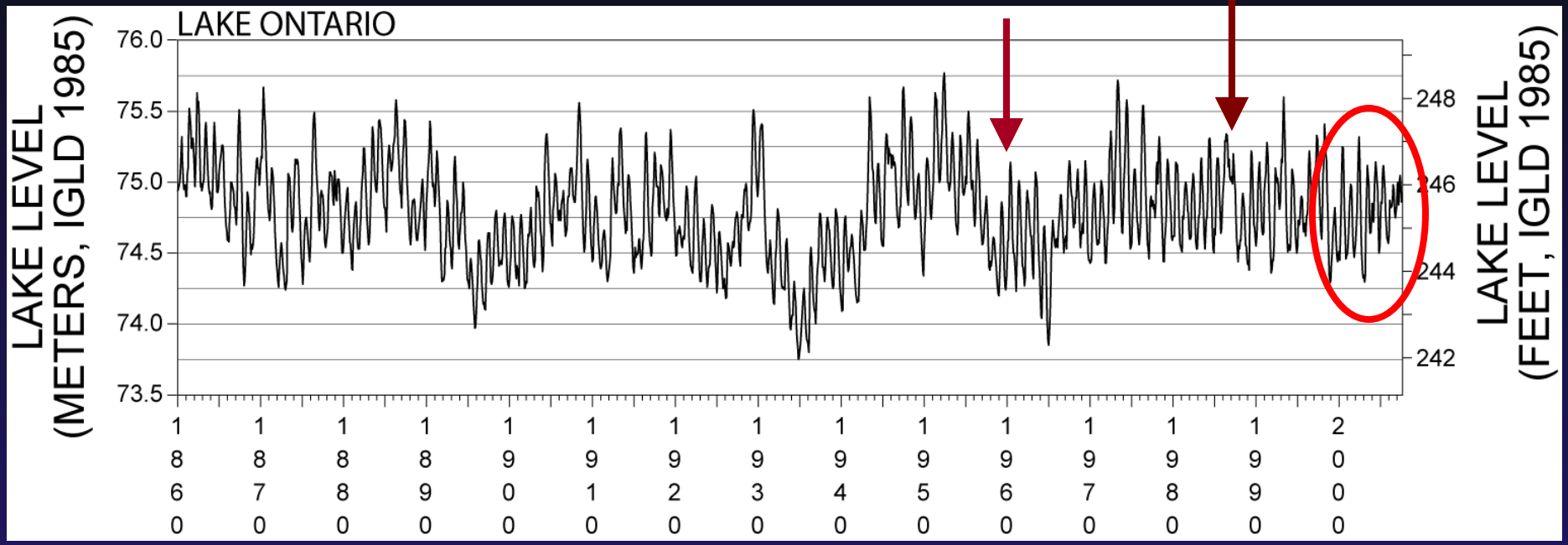
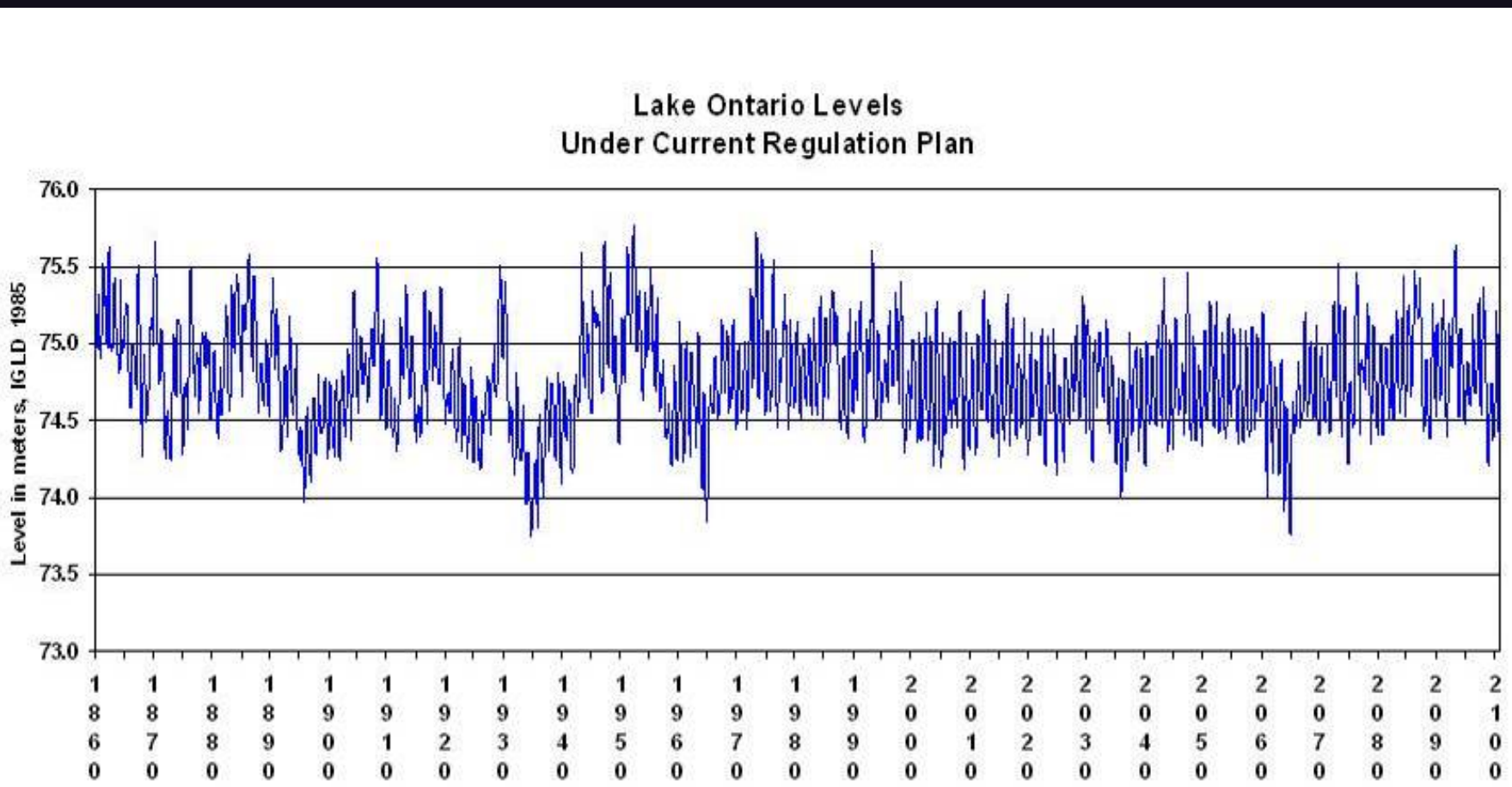
Lake Ontario




Lake Ontario Levels
Under Current Regulation Plan
Level in meters, IGLD 1985
76.0
75.5
75.0
74.5
74.0
73.5
73.0
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100

International Joint Commission

- Lake Ontario-St. Lawrence River Study

Lake Ontario - St. Lawrence River Drainage Basin

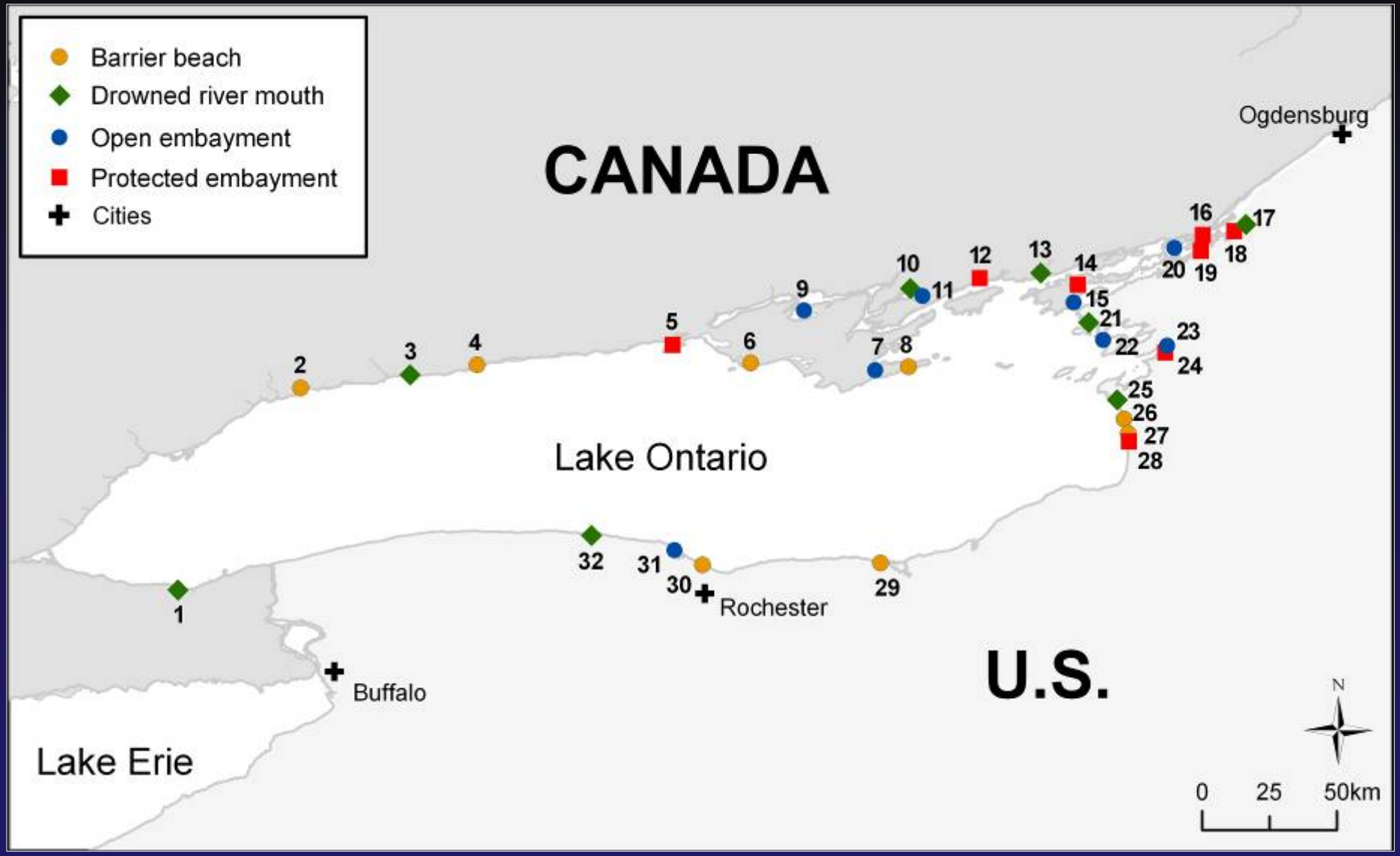
Trois Rivières
Ottawa River
Montréal
Ottawa
Cornwall
CANADA
U.S.A.
St. Lawrence River
Georgian Bay
Lake Huron
Kingston
Toronto
Lake Ontario
Oswego
Buffalo
Lake Erie

Legend

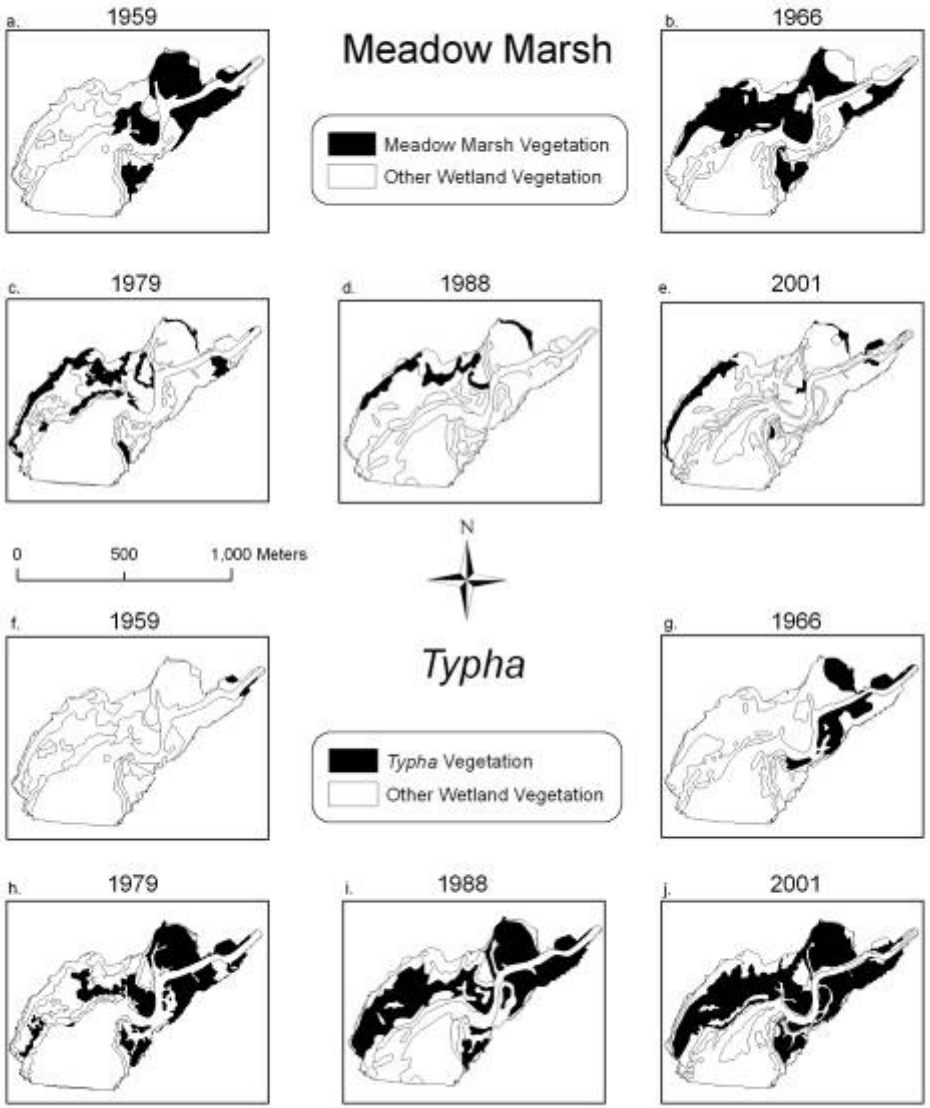
- Cities
- International Border
- St. Lawrence River Drainage Basin
- Lake Ontario Drainage Basin

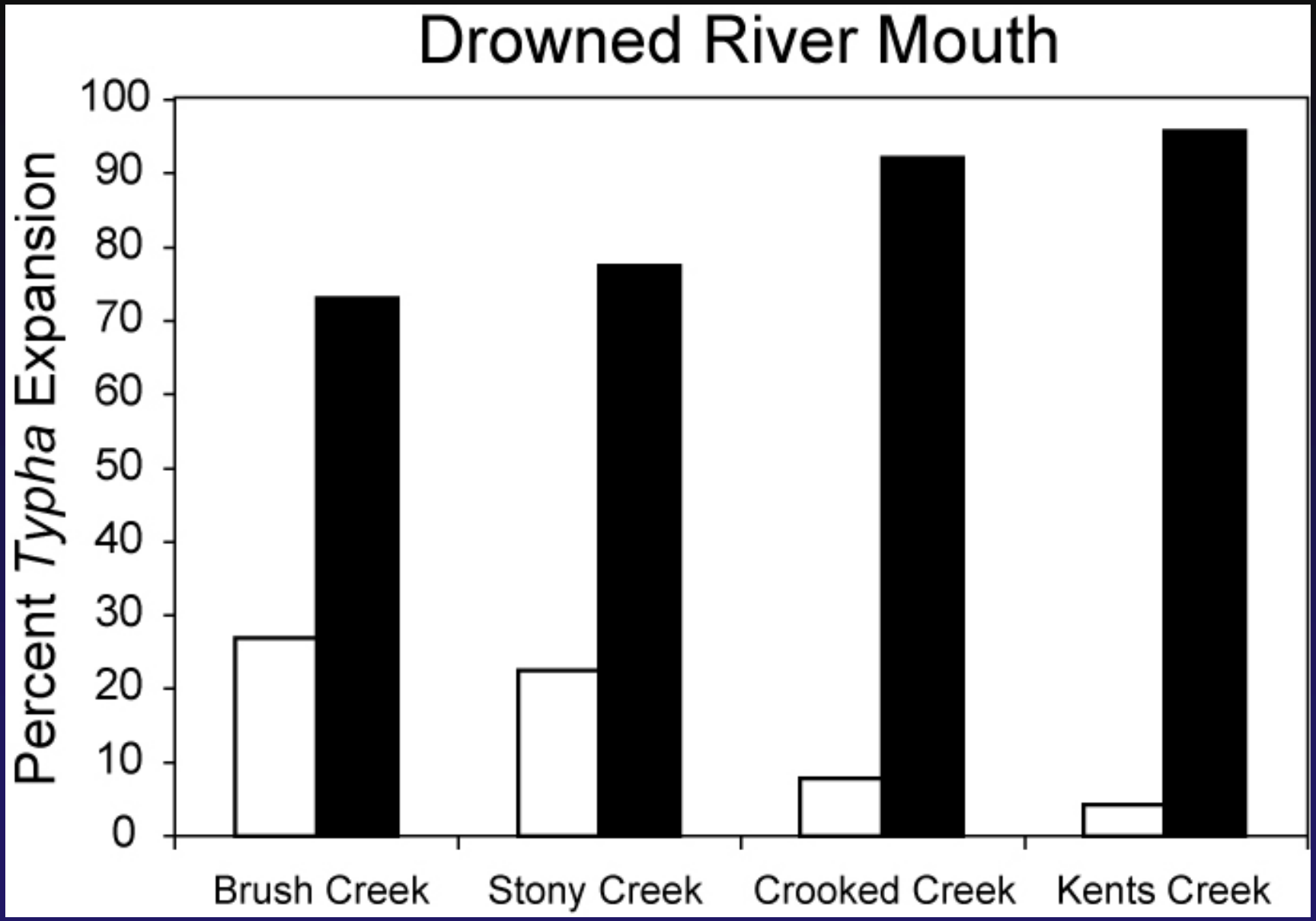
N

60 0 60 120 Kilometers

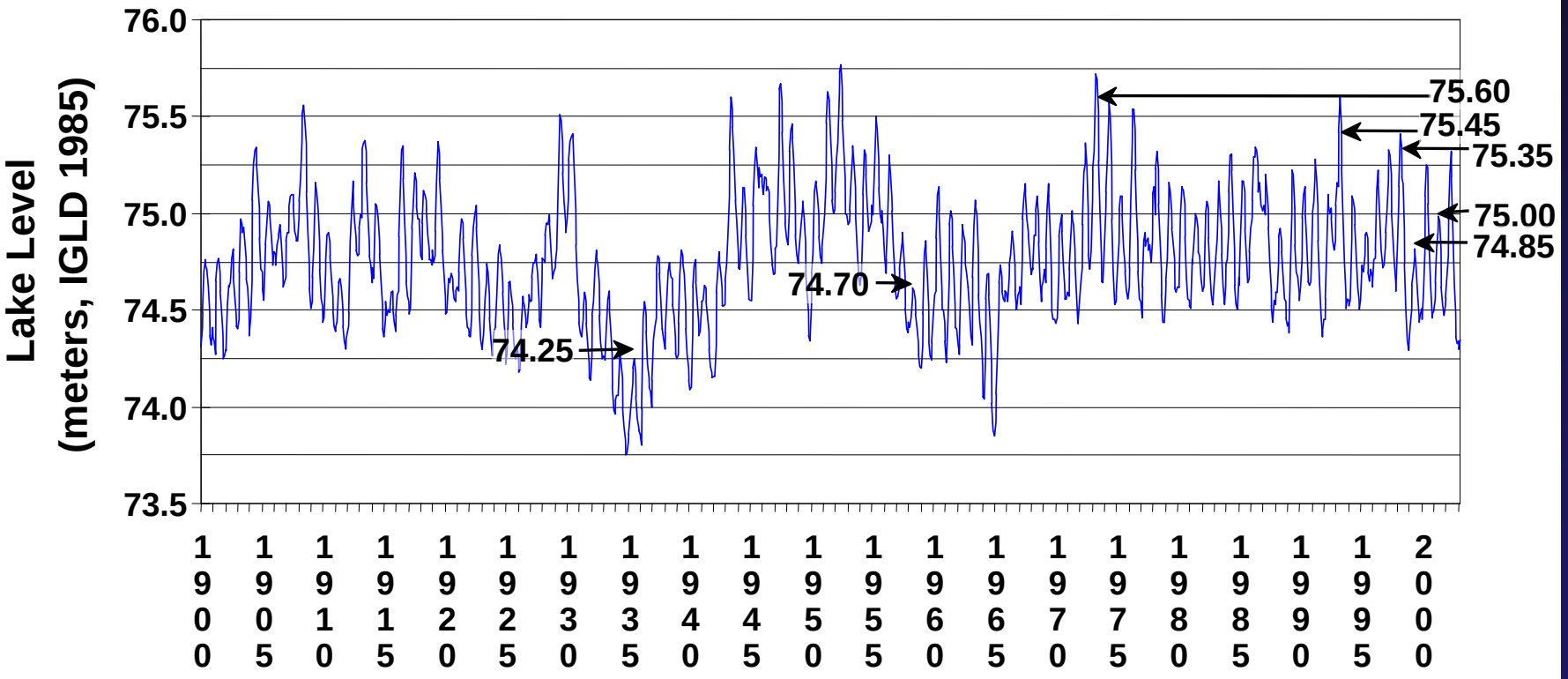

Barrier beach
Drowned river mouth
Open embayment
Protected embayment
Cities
CANADA
Ogdensburg
Lake Ontario
Rochester
Buffalo
Lake Erie
U.S.
N
0
25
50km
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32

Stony Creek


a. 1959
b. 1966
Meadow Marsh
Meadow Marsh Vegetation
Other Wetland Vegetation
c. 1979
d. 1988
e. 2001
0
500
1,000 Meters
N
f. 1959
g. 1966
Typha
Typha Vegetation
Other Wetland Vegetation
h. 1979
i. 1988
j. 2001


Drowned River Mouth
Percent Typha Expansion
100
90
80
70
60
50
40
30
20
10
0
Brush Creek
Stony Creek
Crooked Creek
Kents Creek
toward water
toward meadow marsh

Lake Level Modeling

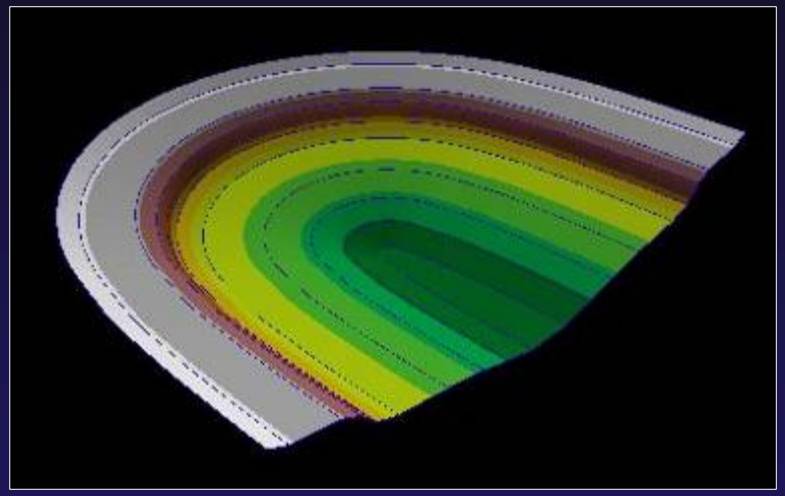


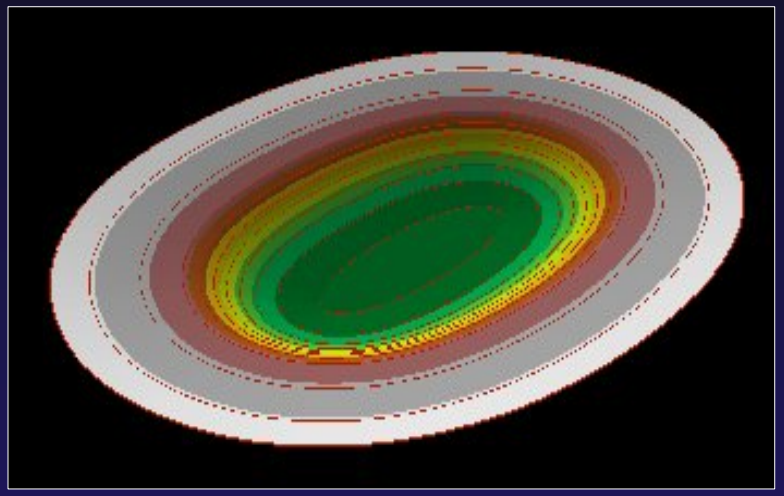
Lake Level Modeling

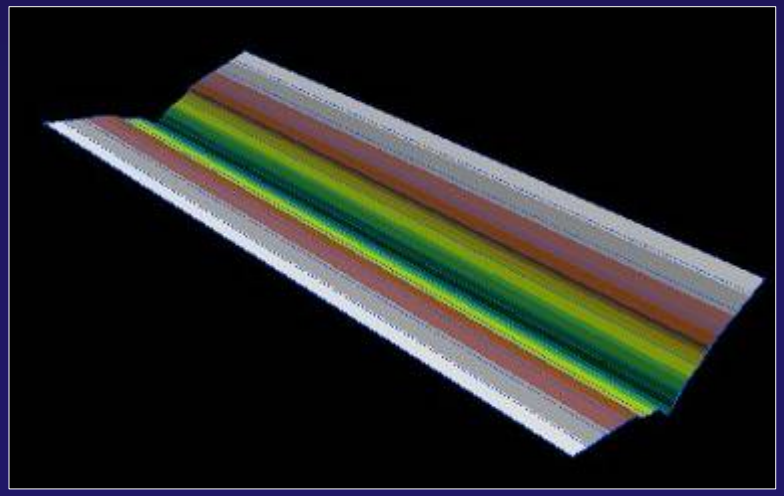
Transect	Elevation	Rationale
A	75.60m	Last flooded 30 years ago
B	75.45m	Last flooded 10 years ago
C	75.35m	Last flooded 5 years ago
D	75.00m	Flooded & dewatered last 5 years
E	74.85m	Last dewatered in growing season 4 years ago
F	74.70m	Last dewatered in growing season 38 years ago
G	74.25m	Last dewatered in growing season 68 years ago

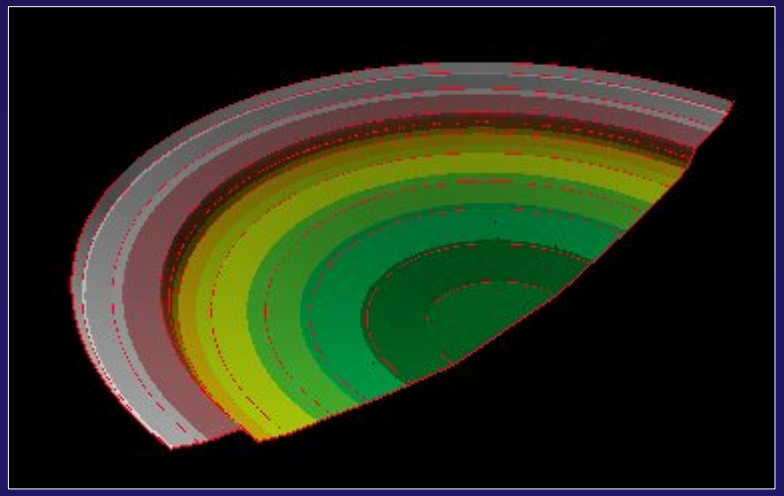
The Isthmus
Bathymetric Survey
04 - November - 2002
Legend
Elevation
74.6 - 75
74.2 - 74.6
73.7 - 74.2
73.3 - 73.7
72.9 - 73.3
72.5 - 72.9
72.1 - 72.5

Generic Shapes Used to Display Averaged Surface Data for Each Geomorphic Type

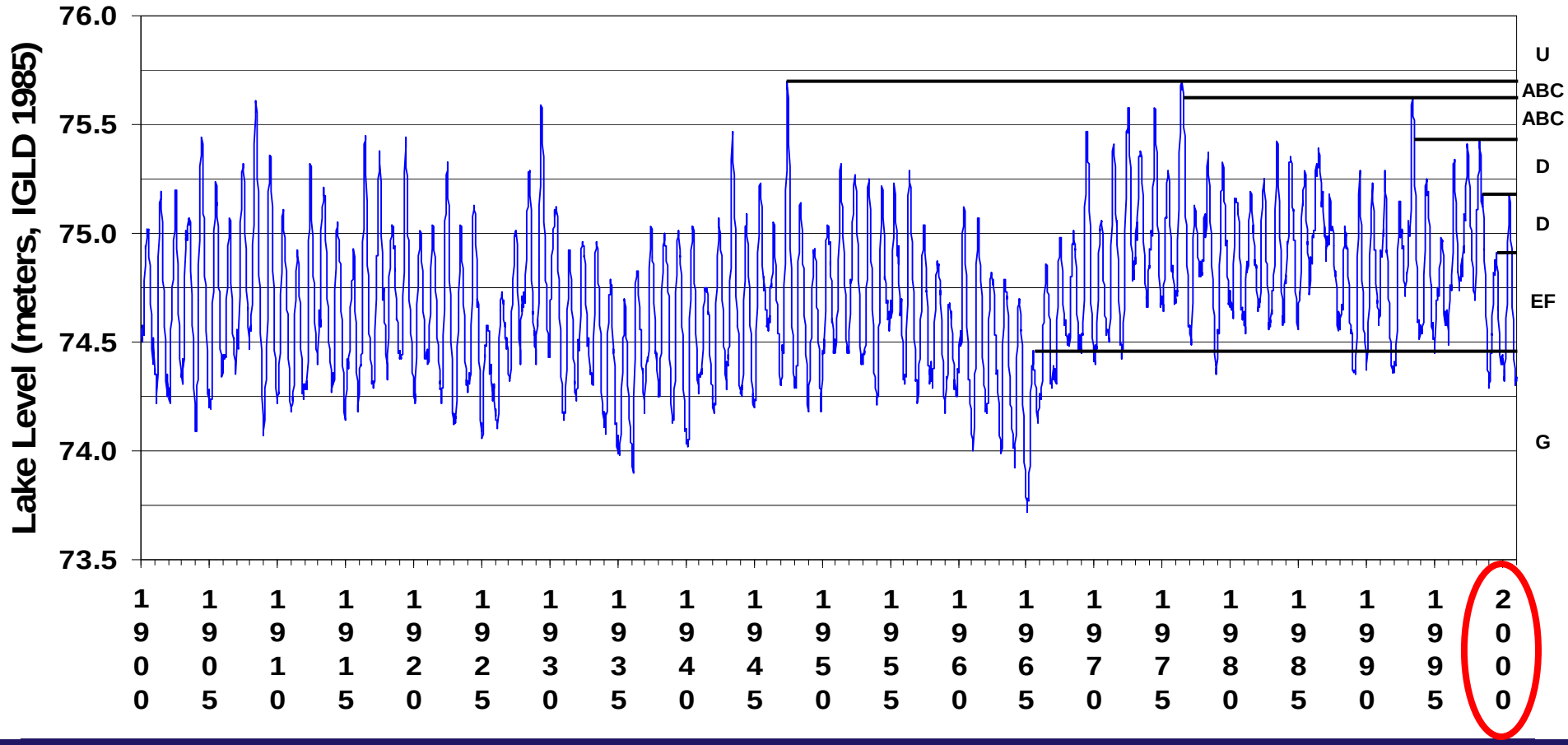








Lake Level Modeling



Model-Derived Predictions

Mean percent meadow marsh in years following low total basin supplies under simulated pre-regulation conditions and five lake-level regulation plans

Plan	Pre	B+	2007	D+	A+	58DD
DRM	39.9	32.2	26.9	26.3	23.6	18.5
BB	48.3	36.1	30.8	30.6	27.1	20.2
OE	24.6	23.2	19.6	19	17.6	15.1
PE	33.2	28.8	23.8	23.4	23.3	15.8

Model-Derived Predictions

Predicted Area of Meadow Marsh (hectares)

Plan	Pre	B+	2007	D+	A+	58DD
United States						
DRM	1026	828	692	676	607	476
BB	1976	1477	1260	1252	1109	827
OE	130	122	103	100	93	80
PE	609	528	437	429	428	290
Canada						
DRM	2187	1765	1474	1442	1294	1014
BB	1628	1217	1038	1032	914	681
OE	367	346	293	281	263	225
PE	2193	1903	1572	1546	1539	1044
TOTAL	**10116**	**8186**	**6869**	**6761**	**6247**	**4637**

Potential Lake Ontario Metrics

- **Lake Level**
  - Frequency that growing season peak level is less than 74.6 m
  - Duration of low lake level periods (no. successive years below 75.0 m)

- **Habitat Diversity**
  - Percent of wetland mapped as meadow marsh
  - Percent of wetland mapped as cattail (or all invasives)
  - Elevation delineating meadow marsh and cattail
  - Rate of expansion/contraction of cattail community
  - Mean percent cover of cattail in meadow marsh quadrats
  - Percent wetland obligate species
  - FQI
  - Number of native taxa

- **Associated Faunal Metrics**

Lake-Level Variability and Water Availability in the Great Lakes

by

D.A. Wilcox, T.A. Thompson, R.K. Booth, J.R. Nicholas

http://pubs.usgs.gov/circ/2007/1311/